

CLAIMS

What is claimed is.

1 1. A capacitor comprising:
2 a fixed charge plate disposed in a substrate;
3 a movable charge plate disposed above the fixed charge plate; and
4 a stiffener affixed to the movable charge plate.

1 2. The capacitor according to claim 1, the movable charge plate further comprising:
2 a first separation distance between the fixed charge plate and the stiffener,
3 wherein the first separation distance is constant.

1 3. The capacitor according to claim 1, further comprising:
2 a first separation distance between the fixed charge plate and the stiffener,
3 wherein the first separation distance is constant; and
4 a second separation distance between the fixed charge plate and portions of the
5 movable charge plate, wherein the second separation distance is variable.

1 4. The capacitor according to claim 1, wherein the fixed charge plate has a first
2 surface area and the movable charge plate has a second surface area that is smaller than the first
3 surface area.

1 5. The capacitor according to claim 1, wherein the movable charge plate comprises a
2 solid surface plate and a broken surface suspension.

1 6. The capacitor according to claim 1, wherein the movable charge plate comprises a
2 solid surface plate and a broken surface suspension, and wherein the broken surface suspension
3 has an undulating configuration.

1 7. The capacitor according to claim 1, wherein the fixed charge plate has a first
2 surface area and the movable charge plate has a second surface area that is smaller than the first
3 surface area, and wherein the movable charge plate comprises a solid surface plate and a broken
4 surface suspension.

1 8. The capacitor according to claim 1, wherein the fixed charge plate has a first
2 surface area and the movable charge plate has a second surface area that is smaller than the first
3 surface area, wherein the movable charge plate comprises a solid surface plate and a broken
4 surface suspension, and wherein the broken surface suspension has an undulating configuration.

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9. A variable capacitor in a semiconductor device comprising:
a movable charge plate disposed in a semiconductor substrate;
means for suspending the movable charge plate;
means for moving the movable charge plate; and
a stiffener disposed upon the movable charge plate.

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10. The variable capacitor in a semiconductor device according to claim 9, wherein
the means for suspending the movable charge plate comprises a flexible dielectric layer.

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11. The variable capacitor in a semiconductor device according to claim 9, wherein
the means for suspending the movable charge plate comprises a flexible section of the movable
charge plate.

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12. The variable capacitor in a semiconductor device according to claim 9, wherein
the means for moving the movable charge plate comprises a fixed actuator plate.

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13. The variable capacitor in a semiconductor device according to claim 9, wherein
the means for moving the movable charge plate comprises a fixed actuator plate and a movable
actuator plate.

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17. A microelectromechanical structure variable capacitor comprising:
a fixed charge plate disposed upon an elevated substrate;
a fixed actuator plate disposed upon a lower substrate, wherein the fixed actuator
plate is below the fixed charge plate;
a movable charge plate suspended above the fixed charge plate; and
a stiffener disposed upon the movable charge plate.

18. The microelectromechanical structure variable capacitor according to claim 17,
wherein the fixed charge plate has a first surface area and the movable charge plate has a
second surface area that is larger than the fixed charge plate.

19. The microelectromechanical structure variable capacitor according to claim 17,
wherein the movable charge plate comprises a solid surface plate and a broken surface
suspension.

20. The microelectromechanical structure variable capacitor according to claim 17,
further comprising:
a movable actuator plate disposed over the fixed actuator plate.

21. The microelectromechanical structure variable capacitor according to claim 17,
wherein the elevated substrate and the lower substrate have a negligible elevational
difference.

1 22. A method of forming a variable capacitor comprising:
2 forming a recess in a substrate;
3 forming a fixed charge plate in the recess;
4 forming a movable charge plate above the fixed charge plate;
5 forming a stiffener upon a portion of the movable charge plate.

1 23. The method of forming a variable capacitor according to claim 22, wherein
2 forming a recess in a substrate further comprises:
3 forming the fixed charge plate;
4 forming a dielectric layer upon the fixed charge plate;
5 forming a movable charge plate upon the dielectric layer; and
6 removing the dielectric layer between the fixed charge plate and the movable charge
7 plate.

1 24. The method of forming a variable capacitor according to claim 22, prior to
2 forming a movable charge plate, further comprising:
3 forming a flexible dielectric above the fixed charge plate.

1 25. The method of forming a variable capacitor according to claim 22, prior to
2 forming a movable charge plate, further comprising:
3 forming a flexible dielectric above the fixed charge plate; and
4 forming multiple through holes in the flexible dielectric.

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1 26. The method of forming a variable capacitor according to claim 22, prior to
2 forming a movable charge plate, further comprising:
3 forming a flexible dielectric above the fixed charge plate; and
4 forming multiple through holes in the flexible dielectric, wherein the multiple
5 through holes have a relative area in a range from about 1% to about 50%.

1 27. The method of forming a variable capacitor according to claim 22, prior to
2 forming a movable charge plate, further comprising:
3 forming a flexible dielectric above the fixed charge plate; and
4 forming at least one through hole in the flexible dielectric.

1 28. The method of forming a variable capacitor according to claim 22, prior to
2 forming a movable charge plate, further comprising:
3 forming a flexible dielectric above the fixed charge plate; and
4 forming at least one through hole in the flexible dielectric below the movable
5 charge plate, wherein the at least one through hole has a relative area in a range from
6 about 10% to about 40%.

1 29. The method of forming a variable capacitor according to claim 22, prior to
2 forming a movable charge plate, further comprising:
3 forming a flexible dielectric above the fixed charge plate; and

4 patterning an undulating suspension section in at least a portion of the flexible
5 dielectric.

1 30. The method of forming a variable capacitor according to claim 22 wherein prior
2 to forming a stiffener, forming a movable charge plate further comprises:

3 patterning an undulating suspension section in at least a portion of the movable
4 charge plate.

1 31. The method of forming a variable capacitor according to claim 22, wherein
2 forming a recess in the substrate further comprises:

3 forming a lower substrate;

4 forming a fixed actuator plate upon the lower substrate;

5 forming an elevated substrate; and

6 forming the fixed charge plate upon the elevated substrate.

1 32. The method of forming a variable capacitor according to claim 22, wherein
2 forming a recess in the substrate further comprises:

3 forming a lower substrate;

4 forming a fixed actuator plate upon the lower substrate;

5 forming an elevated substrate;

6 forming the fixed charge plate upon the elevated substrate; and wherein forming a
7 movable charge plate further comprises:

8 patterning the movable charge plate to form movable actuator plate.